

**IN THE CLAIMS**

Please amend the claims as follows:

1-31 (cancelled)

- 1 32. (previously presented) A method for estimating a property of a fluid, comprising:  
2 (a) transmitting a first acoustic pulse in a first member that is in contact with the  
3 fluid;  
4 (b) detecting a plurality of acoustic pulse echo returns from an interface between  
5 the first member and the fluid; and  
6 (c) estimating the property of the fluid from the plurality of acoustic pulse echo  
7 returns.
- 1 33. (currently amended) The method of claim 32 ~~1~~, wherein the property of the fluid  
2 comprises ~~one at least one of the set consisting of~~ acoustic impedance, density and  
3 viscosity of the fluid.
- 1 34. (currently amended) The method of claim 32 ~~1~~, further comprising:  
2 estimating a reflection coefficient of the interface between the first member and  
3 the fluid.
- 1 35. (currently amended) The method of claim 32 ~~1~~, further comprising:  
2 estimating an acoustic impedance of the first member.

1 36. (currently amended) The method of claim 32 ~~4~~, further comprising:

2 estimating a slope of energy decay for the plurality of acoustic pulse echo  
3 returns.

1 37. (currently amended) The method of claim 36 ~~5~~, wherein estimating the slope of

2 energy decay comprises performing a least squares fit to the plurality of acoustic  
3 pulse echo returns.

1 38. (currently amended) The method of claim 36 ~~5~~, wherein estimating the slope of

2 energy decay comprises dividing each of the plurality of acoustic pulse echo  
3 returns into a plurality of time windows.

1 39. (currently amended) The method of claim 38 ~~7~~, wherein estimating the slope of

2 energy decay further comprises integrating over each of the plurality of time  
3 windows.

1 40. (currently amended) The method of claim 36 ~~5~~, wherein estimating the slope of

2 energy decay further comprises subtracting noise from each of the plurality of  
3 acoustic pulse echo returns.

1 41. (currently amended) The method of claim 32 ~~4~~, further comprising:

2 transmitting a second acoustic pulse through the fluid; and

3       estimating speed of sound through the fluid, using round trip travel time for the  
4       second acoustic pulse between the first member and a second member that is in  
5       contact with the fluid.

1   42. (currently amended) The method of claim 32 ~~1~~, further comprising:  
2       transmitting a second acoustic pulse through the fluid; and  
3       estimating attenuation of the second acoustic pulse through the fluid.

1   43. (currently amended) The method of claim 42 ~~11~~, wherein estimating the attenuation  
2       includes estimating the attenuation at a plurality of frequencies.

1   44. (currently amended) The method of claim 41 ~~10~~, wherein transmitting the second  
2       acoustic pulse further comprises transmitting a plurality of acoustic pulses at a  
3       plurality of frequencies.

1   45. (currently amended) The method of claim 32 ~~1~~, wherein the method is performed  
2       downhole.

1   46. (previously presented) An apparatus for estimating a property of a fluid, comprising:  
2       a vessel that contains the fluid;  
3       an acoustic pulser that transmits a first acoustic pulse into a first vessel member  
4       that is in contact with the fluid;

5 a transducer that detects a plurality of acoustic pulse echo returns from an  
6 interface between the first vessel member and the fluid; and  
7 a processor that estimates the property of the fluid from the plurality of acoustic  
8 pulse echo returns.

1 47. (currently amended) The apparatus of claim ~~46~~ 45, wherein the vessel comprises ~~one~~  
2 of at least one of the set consisting of a flask, pipe, conduit, sample chamber,  
3 flow pipe, tube, channel, and downhole tool housing.

1 48. (currently amended) The apparatus of claim ~~46~~ 45, wherein the property comprises  
2 ~~one of~~ at least one of the set consisting of acoustic impedance, density and  
3 viscosity of the fluid.

1 49. (currently amended) The apparatus of claim ~~48~~ 47, wherein the processor estimates  
2 a reflection coefficient of the interface between the first vessel member and the  
3 fluid.

1 50. (currently amended) The apparatus of claim ~~49~~ 48, wherein the processor measures  
2 acoustic impedance of the first vessel member.

1 51. (currently amended) The apparatus of claim ~~45~~ 45, wherein the processor estimates  
2 a slope of energy decay for the plurality of acoustic pulse echo returns.

1 52. (currently amended) The apparatus of claim 51 20, wherein the processor performs a  
2 least squares fit to the plurality of acoustic pulse echo returns.

1 53. (currently amended) The apparatus of claim 51 20, wherein the processor divides  
2 each of the plurality of acoustic pulse echo returns into a plurality of time  
3 windows to reduce noise.

1 54. (currently amended) The apparatus of claim 53 22, wherein the processor integrates  
2 over each of the plurality of time windows.

1 55. (currently amended) The apparatus of claim 51 20, wherein the processor estimates  
2 the slope of energy decay from a value adjusted for noise for each of the plurality  
3 of acoustic pulse echo returns.

1 56. (currently amended) The apparatus of claim 46 15, wherein the acoustic pulser  
2 transmits a second acoustic pulse through the fluid and the processor estimates the  
3 speed of sound through the fluid using the round trip travel time for the second  
4 acoustic pulse between the first vessel member and a second member that is in  
5 contact with the fluid.

1 57. (currently amended) The apparatus of claim 46 15, wherein the acoustic pulser  
2 transmits a second acoustic pulse through the fluid and the processor estimates  
3 attenuation of the second acoustic pulse through the fluid.

1 58. (currently amended) The apparatus of claim 57 ~~26~~, wherein the processor estimates  
2 the attenuation at a plurality of frequencies.

1 59. (currently amended) The apparatus of claim 56 ~~25~~, wherein the acoustic pulser  
2 transmits a plurality of pulses at a plurality of frequencies.

1 60. (currently amended) The apparatus of claim 46 ~~45~~, wherein the apparatus is located  
2 downhole.

1 61. (previously presented) A method for estimating a property of a fluid, comprising:  
2 (a) generating a first acoustic pulse in the fluid that is in contact with a first  
3 member;  
4 (b) detecting a plurality of acoustic pulse echo returns from an interface between  
5 the first member and the fluid; and  
6 (c) estimating the property of the fluid from the plurality of acoustic pulse echo  
7 returns.

1 62. (previously presented) An apparatus for estimating a property of a fluid, comprising:  
2 a chamber that contains the fluid;  
3 a transmitter that sends a first acoustic pulse into the fluid that is in contact with a  
4 first chamber member;  
5 a transducer that detects a plurality of acoustic pulse echo returns from an  
6 interface between the first chamber member and the fluid; and

7 a processor that estimates the property of the fluid using the plurality of acoustic  
8 pulse echo returns.

1 63. (previously presented) A downhole tool which is deployed in a borehole for  
2 estimating a property of a downhole fluid, comprising:  
3 a vessel that contains the fluid;  
4 an acoustic pulser that transmits a first acoustic pulse into a first vessel member  
5 that is in contact with the fluid;  
6 a transducer that detects a plurality of acoustic pulse echo returns from an  
7 interface between the first vessel member and the fluid; and  
8 a processor that estimates the property of the fluid using the plurality of acoustic  
9 pulse echo returns.

1 64. (currently amended) The downhole tool of claim 63 32, wherein the vessel  
2 comprises one of a flask, pipe, conduit, sample chamber, flow pipe, tube, channel  
3 and downhole tool housing.

1 65. (currently amended) The downhole tool of claim 64 33, wherein the property  
2 comprises one of acoustic impedance, density and viscosity of the fluid.

1 66. (currently amended) The downhole tool of claim 65 34, wherein the processor  
2 estimates a reflection coefficient of the interface between the first vessel member  
3 and the fluid.

- 1 67. (currently amended) The downhole tool of claim 63 32, wherein the processor  
2 estimates a slope of energy decay for the plurality of acoustic pulse echo returns.
- 1 68. (currently amended) The downhole tool of claim 67 36, wherein the processor  
2 performs a least squares fit to the plurality of acoustic pulse echo returns.
- 1 69. (previously presented) A method for estimating a property of a fluid, comprising:  
2 (a) generating a first acoustic pulse in a first member that is in contact with the fluid;  
3 (b) detecting a plurality of acoustic pulse echo returns from an interface between the  
4 first member and the fluid; and  
5 (c) estimating the property of the fluid from the plurality of acoustic pulse echo  
6 returns.